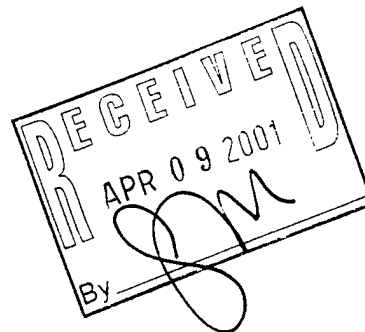


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### Statement of Problem Studied and Results

Problems studied included existence and properties of solutions of nonlinear partial differential equations, including applications to shock waves and to differential geometry covering a very wide range of subjects. [4,7,10] developed variational approaches for an elliptic boundary value problem with nonlinear forcing term  $a(x)g(u)$ . The function  $a$  is allowed to change sign. New variational arguments to obtain positive solutions were introduced. [6] treats related problems using degree theory. In [5] and extended in [9] it was shown that for a constrained variational problem local  $C^1$  minima are also  $H^1$  local minima. This is used to obtain multiple solutions for a class of problems.

In [3] new results on existence and properties of principal eigenvalue for a general second order elliptic operator under Dirichlet conditions are obtained for arbitrary domains.

Gui studied semilinear heat equations and conformal metrics in  $\mathbb{R}^n$  as well as its Lotka-Volterra competition model. He also proved symmetry of the blowup set of porous-media-type equations.

Nabutovsky [20] used mathematical logic to study the space of triangulations of a compact manifold. A very surprising development, it connects with quantum gravity.

[21,22] deal with fluid dynamics vortex methods and entropy for hyperbolic conservation laws. Gui worked on problems for collisionless plasma.

### Publications

1. Berestycki, H.; Caffarelli, L. A.; Nirenberg, L. Symmetry for elliptic equations in a half space. *Boundary value problems for partial differential equations and applications*, 27–42. RMA Res. Notes Appl. Math., 29. Masson, Paris, 1993.
2. Berestycki, Henri; Nirenberg, Louis; Varadhan, Srinivasa. État fondamental et principe du maximum pour les opérateurs elliptiques du second ordre dans des domaines généraux. *C. R. Acad. Sci. Paris Sér. I Math.* **317** (1993), no. 1, 51–56.
3. Berestycki, H.; Nirenberg, L.; Varadhan, S. R. S. The principal eigenvalue and maximum principle for second-order elliptic operators in general domains. *Comm. Pure Appl. Math.* **47** (1994), no. 1, 47–92.
4. Berestycki, Henri; Capuzzo-Dolcetta, Italo; Nirenberg, Louis. Problèmes elliptiques indéfinis et théorèmes de Liouville non linéaires. *C. R. Acad. Sci. Paris Sér. I Math.* **317** (1993), no. 10, 945–950.
5. Brezis, Haim; Nirenberg, Louis  $H^1$  versus  $C^1$  local minimizers. *C. R. Acad. Sci. Paris Sér. I Math.* **317** (1993), no. 5, 465–472.
6. Berestycki, H.; Capuzzo-Dolcetta, I.; Nirenberg, L. Superlinear indefinite elliptic problems and nonlinear Liouville theorems. *Topol. Methods Nonlinear Anal.* **4** (1994), no. 1, 59–78.
7. Berestycki, Henri; Capuzzo-Dolcetta, Italo; Nirenberg, Louis. Variational methods for indefinite superlinear homogeneous elliptic problems. *NoDEA Nonlinear Differential Equations Appl.* **2** (1995), no. 4, 553–572.
8. Brezis, H.; Nirenberg, L. Degree theory and BMO. I. Compact manifolds without boundaries. *Selecta Math. (N.S.)* **1** (1995), no. 2, 197–263.
9. Tehrani, Hossein T.  $H^1$  versus  $C^1$  local minimizers on manifolds. *Nonlinear Anal.* **26** (1996), no. 9, 1491–1509.
10. Tehrani, Hossein T. On indefinite superlinear elliptic equations. *Calc. Var. Partial Differential Equations* **4** (1996), no. 2, 139–153.
11. Tehrani, Hossein T. Infinitely many solutions for indefinite semilinear elliptic equations without symmetry. *Comm. Partial Differential Equations* **21** (1996), no. 3-4, 541–557.

12. Gui, Changfeng; Lin, Fang-Hua. Regularity of an elliptic problem with a singular nonlinearity. *Proc. Roy. Soc. Edinburgh Sect. A* **123** (1993), no. 6, 1021–1029.
13. Gui, Changfeng; Wang, Xuefeng. The critical asymptotics of scalar curvatures of the conformal complete metrics with negative curvature. *Duke Math. J.* **76** (1994), no. 1, 293–302.
14. Gui, Changfeng; Wang, Xuefeng. Life spans of solutions of the Cauchy problem for a semilinear heat equation. *J. Differential Equations* **115** (1995), no. 1, 166–17.
15. Gui, Changfeng; Lou, Yuan. Uniqueness and nonuniqueness of coexistence states in the Lotka-Volterra competition model. *Comm. Pure Appl. Math.* **47** (1994), no. 12, 1571–1594.
16. Gui, Changfeng. Symmetry of the blow-up set of a porous medium type equation. *Comm. Pure Appl. Math.* **48** (1995), no. 5, 471–500.
17. Nabutovsky, A. Einstein structures: existence versus uniqueness. *Geom. Funct. Anal.* **5** (1995), no. 1, 76–91.
18. Nabutovsky, Alexander. Non-recursive functions, knots “with thick ropes”, and self-clenching “thick” hyperspheres. *Comm. Pure Appl. Math.* **48** (1995), no. 4, 381–428.
19. Nabutovsky, Alexander. Fundamental group and contractible closed geodesics. *Comm. Pure Appl. Math.* **49** (1996), no. 12, 1257–1270.
20. Nabutovsky, A. Geometry of the space of triangulations of a compact manifold. *Comm. Math. Phys.* **181** (1996), no. 2, 303–330.
21. Nabutovsky, A. Geometry of the space of triangulations of a compact manifold. *Comm. Math. Phys.* **181** (1996), no. 2, 303–330.
22. Liu, Jian-Guo; Xin, Zhou Ping. Convergence of vortex methods for weak solutions to the 2-D Euler equations with vortex sheet data. *Comm. Pure Appl. Math.* **48** (1995), no. 6, 611–628.
23. LeFloch, Philippe G.; Liu, Jian-Guo. Discrete entropy and monotonicity criteria for hyperbolic conservation laws. *C. R. Acad. Sci. Paris Sér. I Math.* **319** (1994), no. 8, 881–886.
24. Fang, Yi. On minimal annuli in a slab. *Comment. Math. Helv.* **69** (1994), no. 3, 417–430.
25. Guo, Yan; Strauss, Walter A. Instability of periodic BGK equilibria. *Comm. Pure Appl. Math.* **48** (1995), no. 8, 861–894.
26. Guo, Yan. Singular solutions of the Vlasov-Maxwell system on a half line. *Arch. Rational Mech. Anal.* **131** (1995), no. 3, 241–304.

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